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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/544,252

08/02/2005

Bert Reents

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PAUL AND PAUL
2000 MARKET STREET
SUITE 2900
PHILADELPHIA, PA 19103

EXAMINER

LEADER, WILLIAM T

ART UNIT

PAPER NUMBER

1795

NOTIFICATION DATE

DELIVERY MODE

04/03/2009

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/544,252	Applicant(s) REENTS ET AL.	
	Examiner WILLIAM T. LEADER	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>8/2/05; 10/28/05</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

1. The preliminary amendment filed on August 2, 2005, has been entered. Claims 1-19 are pending.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-4 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Gandikota et al (EP 1 069 212 A1).

4. The Gandikota et al patent is directed to a method for electroplating a workpiece having high aspect ratio holes (abstract). An apparatus that can be used to perform the electroplating method is illustrated in figure 1. The apparatus shows plater 10 which includes an electrolyte container 12. Workpiece 22 is placed in the plater along with an anode 16. Power supply 20 provides a voltage between the workpiece and the anode. Pulse reverse current such as that illustrated in figure 4 is applied. The forward current pulse may have a current density between about 5 and 80 mA/cm² (0.5-8 A/dm²). The time period during which the forward current pulse is applied has a duration between about 0.1 and 20 seconds (100 to 20,000 ms). The reverse current pulse may have a current density between about 5 and 100 mA/cm² (0.5-10 A/dm²). The time period during which the reverse current pulse is applied has a duration between about 0.02 and 3 seconds (20 to 3,000 ms). See paragraphs [0029] and [0030]. In the example described in

paragraphs [0040] and [0041] the duration of the forward pulse was between about 4 and 16 seconds (4,000 and 16,000 ms), while the duration of the reverse pulse was 0.3 seconds (300 ms). Thus, the frequency of the pulses applied in the example was less than 6 Hertz, thereby falling within the range of at most about 6 Hertz recited in applicant's claim 1.

5. With respect to claim 2, the ratio of the duration of forward to reverse current pulses in the example was 13.3 to 53.3 (4.0/0.3 to 16.0/0.3). This range falls within the range recited in claim 2.

6. With respect to claim 3, in the example the duration of the forward current pulse of one cycle was 4 to 16 seconds. This falls within the range of at least about 100 ms (0.1 second) recited in claim 3.

7. With respect to claim 4, in the example the duration of the reverse current pulse of one cycle was 0.3 second (300 ms). This falls within the range of at least about 0.5 ms recited in claim 4.

8. With respect to claim 17, Gandikota discloses that a copper electroplating bath is used (paragraph [0033]).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

11. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gandikota et al (EP 1 069 212 A1).

12. Gandikota et al is interpreted as above. Claim 5 recites a peak current density of the forward current pulse of about 3-15 A/dm². Gandikota discloses a range of 0.5-8 A/dm² (5-80 mA/cm²). See paragraph [0029]. The range disclosed by Gandikota overlaps the range recited by applicant. Choice of a value from within the range of Gandikota would have been obvious at the time the invention was made. See MPEP 2144.05 (Overlap or Ranges).

13. Claim 6 recites a peak current density of the reverse pulse of about 10-60 A/dm². Gandikota discloses a range of 0.5 to 10 A/dm² (5-100 mA/cm²). See paragraph [0030]. The range disclosed by Gandikota overlaps the range recited by applicant. Choice of a value from within the range of Gandikota would have been obvious at the time the invention was made.

14. Claims 7, 13 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Geissler et al (US 6,238,529) in view of Gandikota et al (EP 1 069 212 A1).

15. The Geissler et al patent is directed to a method and apparatus for plating printed circuit boards. The boards may be provided with fine boreholes having a diameter of 0.3mm and less, while the board may have a thickness of 3.5 mm and more (column 3, lines 20-30). Such holes have a high aspect ratio of at least 11.6. Figure 2a illustrates a continuous plating system with clip-type contacts 11. Figure 2b illustrates a continuous plating system with roller-type contacts 12. Geissler discloses that the continuous plating systems are suitable for electroplating with bipolar pulse current. Effective current densities of up to 20 A/dm² may be used. The pulse electroplating process is particularly advantageous for electroplating very fine boreholes (column 8, lines 59-65). As shown in figures 2a and 2b, upper anode 1 and lower anode 2 are provided on each side of the circuit board being plated, and electrical contact is made to each side of the circuit board. Thus, voltages are applied to first and second sides of the circuit board. Geissler also discloses providing electrolyte spraying arrangements as well as arrangements, such as pumps and pipelines, for conveying the electrolytic fluid towards the surfaces of the printed circuit boards (column 3, lines 49-53). Figures 2a and 2b show spraying tubes 13. This corresponds to delivering electrolyte towards the workpiece as recited in applicant's claim 13. Geissler discloses that copper may be deposited on the printed circuit boards (column 4, lines 1-6). The anodes may insoluble anodes which are dimensionally stable as recited in applicant's claim 16 (column 5, lines 8-12).

16. Geissler et al does not disclose the detailed parameters of the applied bipolar pulse current. Claim 7 differs from the process of Geissler by including the parameters of the applied current recited in claims 1 and 2. As explained above, Gandikota discloses the use of bipolar

pulse current to plate fine holes where the current has parameters which are recited in claims 1 and 2. The prior art is indicative of the level of skill of one of ordinary skill in the art. It would have been obvious at the time the invention made to have utilized the current parameters disclosed by Gandikota in the process of Geissler because these parameters are effective in plating small, high aspect ratio holes.

17. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Geissler et al (US 6,238,529) in view of Gandikota et al (EP 1 069 212 A1) as applied to claims 7, 13 and 16 above, and further in view of Hubel (US 6,132,584).

18. Claims 8 and 9 additionally differ by reciting applying a first pulsed voltage to a first side of the workpiece and a second pulsed voltage to a second side of the workpiece. The Hubel patent is directed to a method and apparatus for plating workpieces such as printed circuit boards using unipolar or bipolar pulses. See the abstract and column 1, lines 7-14. Figure 6 illustrates a circuit arrangement useful for plating printed circuit boards. The apparatus includes pulse current units 19, an electroplating bath 20 and two direct current sources 2. An anode 22 is arranged on each side of the circuit board. Each side of the circuit board is separately supplied with electroplating current. Both pulse current units can work either in asynchronous or synchronous manner with one another. To electroplate the holes of circuit boards, it is advantageous if the pulse sequences of the same frequency of both pulse current units are synchronized and if at the same time there is phase displacement of the pulses. The phase displacement is such that during the electroplating phase on one side of the circuit board, the

deplating pulse occurs on the other side. In this case, the dispersion of the metal in the holes is improved. Thus, Hubel teaches offsetting first and second current pulses by approximately 180° as recited in applicant's claim 9. See column 7, line 63 to column 7, line 17.

19. It would have been obvious at the time the invention was made to have provided independent supply of electroplating current to each side of the circuit board being plated and to have offset the currents as taught by Hubel in the process suggested by Geissler in view of Gandikota because plating in the holes would have been improved.

20. With respect to claim 10, Hubel discloses in figure 1e providing two forward current pulses and one reverse current pulse with a zero current break between the two forward pulses.

21. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Geissler et al (US 6,238,529) in view of Gandikota et al (EP 1 069 212 A1) as applied to claims 7, 13 and 16 above, and further in view of Martin et al (US 6,071,398).

22. Claims 11 and 12 additionally differ by reciting varying a current parameter during the course of plating the workpiece. The Martin et al patent is directed to a process using programmed pulse electroplating. The process involves varying current parameters such as the ratio of peak reverse current density to peak forward current density during plating. The process provides metal deposits of uniform thickness and appearance upon the substrate. See the abstract. The process may be used to deposit copper onto printed circuit boards. See example 2. It would have been obvious to have varied the ratio of peak forward to reverse current as taught by Martin because uniformity and appearance would have been improved.

23. Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Geissler et al (US 6,238,529) in view of Gandikota et al (EP 1 069 212 A1) as applied to claims 7, 13 and 16 above, and further in view of Scanlon et al (GB 2 101 159).

24. Claims 14 and 15 differ by reciting forcing electrolyte under agitation toward the workpiece, and providing the electrolyte with a flow velocity at least about 1 m/sec. The Scanlon et al patent is directed to high speed plating of planar workpieces such as printed circuit boards. See the abstract. In order to enhance the electroplating characteristics of the apparatus, means are provided for agitating the electrolyte solution in the area of the workpiece path. The means provide for spraying electrolytic solution directly on the surfaces of the workpieces as shown in figure 6. The apparatus includes vertically extending nozzle defining towers 36, 36. See page 3, lines 15-24. The solution sprayed from the nozzles in towers 36, 36 preferably has a velocity of approximately 2000 feet per minute (approximately 10 m/sec). See page 4, lines 116-119. This value falls within the range recited in applicant's claim 15. It would have been obvious to have forced the electrolyte under agitation toward the workpiece at a high velocity as taught by Scanlon because the electrolyte in the vicinity of the workpiece would have been replenished providing increased an concentration of the metal such as copper being deposited.

25. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Geissler et al (US 6,238,529) in view of Gandikota et al (EP 1 069 212 A1) as applied to claims 7, 13 and 16 above, and further in view Schumacher et al (5,976,341).

26. Claims 18 and 19 differ by reciting providing a compound capable of oxidizing copper in the plating electrolyte. The Schumacher et al patent is directed to a process for electrodepositing a metal such as copper onto printed circuit boards. See the abstract and column 1, lines 7-11. Schumacher discloses that the plating solution contains compounds of an electrochemically reversible redox couple. For regenerating the plating solution which has become diminished by consumption of metal ions, the plating solution is passed along the anodes, whereby the oxidizing compounds of the redox couple are formed. Thereupon, the solution is guided through a metal-ion generator which provides for the oxidizing compounds to react with metal parts and to from metal ions (column 3, lines 20-38). A suitable redox couple is $\text{Fe}^{2+}/\text{Fe}^{3+}$, and one compound that can be used is ferric sulfate nonahydrate (column 6, lines 38-46). It would have been obvious to have included an oxidizing compound as taught by Schumacher because it would have allowed the plating solution to have been effectively replenished.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to WILLIAM T. LEADER whose telephone number is (571) 272-1245. The examiner can normally be reached on Mondays-Thursdays and alternate Fridays, 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/William Leader/
March 27, 2009

/PATRICK RYAN/
Supervisory Patent Examiner, Art Unit 1795